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ABSTRACT

The Science Module for Grade 6 is designed as a 12-week block of instruction within the Science and Health course for students in the Los Angeles Unified School District. The purpose of this publication is to provide a basic science curriculum that builds on the K-5 science experience and emphasizes science as fundamental to good citizenship and effective participation in today's society. The contents of this publication are intended to facilitate the planning of classroom instruction to promote the concepts and skills identified by the school district's curriculum. Contents include: (1) a summary of representative objectives; (2) time schedule and sequence of units; (3) teacher responsibilities; (4) guidelines for assignment of homework; (5) units of study (containing the objectives, content outlines and continuum skills for six units); (6) a sample teacher-directed lesson; (7) teaching strategies; (8) evaluation procedures; and (9) tips for parents. Appendices consist of a list of resources and the science continuum for both elementary and secondary levels. (ML)

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FOREWORD

The Science Module for Grade 6 is designed to be implemented as a twelve-week block of instruction within the sixth grade course in Science and Health at the junior high school. The purpose of this publication is to provide a basic science curriculum that builds on the K-5 science experience and emphasizes science as fundamental to good citizenship and effective participation in today's society.

Science is the discipline which involves the gathering and organizing of knowledge to explain natural phenomena. It is also viewed as a set of processes, skills, and attitudes that can be used to acquire and compile information systematically. The dynamic relationship between systematic processes and knowledge is the essence of the scientific enterprise which permeates every aspect of our contemporary culture.

Science 6 is designed for all students. The emphasis of this course is on providing students with the knowledge and skills necessary for leading successful and productive lives in a technological society. This course also provides students with a variety of science-related educational choices to assist them in making future career plans and preparations.

This instructional course outline consists of six units. Each unit is organized into representative objectives followed by a content outline and continuum skills. An "E" or "S" preceding a numerical code refers to objectives in the elementary and secondary science skills continuums. The contents of this publication are designed to facilitate the planning of classroom instruction to promote the concepts and skills for science education as stated in the "Science Education Continuum" in the Elementary School Curriculum: A Balanced Program (Los Angeles Unified School District: Instructional Planning Division, Publication No, X-107, 1979), and the Secondary Science Continuum, Los Angeles Unified School District, 1978. Copies of these continuums are included in the Appendixes.

For the subject of science to be a dynamic factor in the lives of students, instruction must be both relevant and appropriate to the developmental level of the pupils. This publication provides laboratory investigations and other activities to motivate individual development of critical thinking, decision-making, and problem solving.

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SUMMARY OF REPRESENTATIVE OBJECTIVES

UNIT TITLE	REPRESENTATIVE UNIT OBJECTIVES
Unit One	The student should be able to:
SCIENCE - A WAY TO ACQUIRE AND ORGANIZE KNOWLEDGE	- Identify that science is an interconnecting body of knowledge, processes, and characteristics that explain the known universe and its relationship to human life. - Participate in scientific inquiry and problem solving. - Express an appreciation for the contributions of science in improving our daily lives and in preparing for the future.
Unit Two	
THE SCIENTIST	- Identify and relate scientists and the current fields of science to the fundamental branches of science. - Acquire knowledge of and analyze the multitude of science and science-related career opportunities. - Apply the skills and processes used by a scientist and relate them to human endeavors that have greatly benefited society.
Unit Three	
TOOLS AND TECHNIQUES OF SCIENCE	- Utilize scientific equipment and apparatus in an appropriate manner. - Develop scientific vocabulary, viewing such vocabulary as an efficient means of effective communication. - Use basic measurements in the (SI) metric system as a basis for scientific commonality and accuracy of quantitative measurements.

UNIT TITLE	REPRESENTATIVE UNIT OBJECTIVES
Unit Four MATTER, ENERGY, AND RESOURCES	- Investigate and identify the distinguishing characteristics of matter and energy. - Investigate and provide examples of the effects of energy upon matter. - Investigate and demonstrate an appreciation of the relationships between the interchangeability of the forms of energy and the search for energy alternatives to fossil fuels.
Unit Five ORGANISMS AND THE ENVIRONMENT	- Investigate and identify the characteristics distinguishing living from non-living organisms. - Investigate and classify living things by their observable characteristics. - Investigate and appreciate the interdependence of humankind with all other living organisms. - Describe examples of an organism's adaptation to its environment.
Unit Six THE UNIVERSE	- Investigate and demonstrate an understanding of the ordered interrelationships of objects in our solar system and the known universe. - Investigate forces which influence patterns in space and create change.

TIME SCHEDULE AND SEQUENCE OF UNITS

The purpose of this instructional course outline is to provide a curriculum for teaching the Science Module of the grade 6 Environmental Science-Health course in the junior high school. The Science Module covers 12 weeks of instruction. The teacher is referred to the Health Module, grade 6, for teaching the remaining 6 weeks of the semester.

The instructional content is organized into six broad units dealing with the processes of science and the fields of physical, biological, and earth and space sciences. Units 1, 2, and 3 are introductory and are not intended to be covered in depth because the content of these units may be used extensively in the teaching of Units 4, 5, and 6. Since Units 4, 5, and 6 are not sequential, they may be taught in any order; but all units must be taught at some time during the course.

UNIT	TOPICS	WEEKS
ONE	SCIENCE - A WAY TO ACQUIRE AND ORGANIZE KNOWLEDGE	
TWO	THE SCIENTIST	1
THREE	TOOLS AND TECHNIQUES OF SCIENCE	
FOUR	MATTER, ENERGY, AND RESOURCES	4
FIVE	ORGANISMS AND THE ENVIRONMENT	4
SIX	THE UNIVERSE	3
	Total Weeks	12

TEACHER RESPONSIBILITIES

Teachers are responsible for creating, maintaining, and fostering a classroom environment and climate for learning which provides for instructional excellence and achievement. In order to successfully maintain such an environment, teachers are responsible for:

1. Providing students and parents with a clear statement of instructional objectives, overall goals, and standards of expected progress and achievement.

2. Providing instruction which incorporates a diagnostic-prescriptive program for learning all required skills and concepts.

3. Following the timeline as closely as possible, preparing instructional activities for the entire class period, and striving for mastery of content and process skills.

4. Having evidence in the classroom of lesson planning to meet the educational needs of the students and the goals of the instructional program.

5. Providing regular instruction and practice in preparing students to take and succeed on tests and other measures of achievement.

6. Providing well-defined and consistently maintained classroom standards for academic achievement, citizenship, and work habits.

7. Providing regularly assigned student homework designed to reinforce classroom instruction.

8. Providing students and parents with an explanation of the standards used for assigning marks.

9. Providing prompt feedback to students on quizzes, homework, and other class assignments.

10. Recognizing individual student progress and exceptional achievements and displaying student accomplishments and products in the classroom.

11. Recording a minimum of one grade per week in the rollbook for each student.

12. Keeping parents regularly informed of the educational progress and achievement of the student.

13. Informing parents of outstanding progress and accomplishment.

14. Notifying parents of any signs of significant academic decline in student effort or achievement.

15. Providing parents with suggestions on how to help the student study and complete homework assignments.

16. Inviting administrators, department chairpersons, and fellow teachers to visit their classrooms and participate in a sharing of effective and innovative lessons.

GUIDELINES FOR ASSIGNMENT OF HOMEWORK

The guidelines that follow should be considered when planning homework assignments:

1. Homework is an important resource for teachers in helping students to learn.

2. Homework may be scheduled when appropriate over an extended period of time which may include weekends.

3. Homework assignments should be reasonable in length, content, and required resources.

4. Homework should be assigned to reinforce, extend, and enrich areas which have been taught.

5. Homework assignments should be related to subject objectives.

6. Homework assignments and due dates should be thoroughly explained by the teacher and understood by the student.

7. Homework once appropriately assigned by the teacher becomes the responsibility of the student to know the content, process and due date, and to complete and return as required.

8. Completed homework assignments should be acknowledged and/or evaluated by the teacher and reviewed with students when appropriate.

Parents/guardians should be informed of homework schedules, including dates given and time allowance. They should also understand the level of independent work expected of the student and the parental help and involvement required.

UNIT ONE: SCIENCE - A WAY TO ACQUIRE AND ORGANIZE KNOWLEDGE

Representative Unit Objectives

The content in Unit One should be presented as an overview initially and then integrated into Units Four, Five, and Six as students investigate science in the specific subject areas.

The student should be able to:

- Identify that science is an interconnecting body of knowledge with processes and characteristics that explain the known universe and its relationship to human life.
- Participate in scientific inquiry and problem solving.
- Express an appreciation for the contributions of science in improving our daily lives and in preparing for the future.

Content	Continuum Skills	
I. Science provides a way to seek solutions to problems and answer questions.	The student should be able to:	
A. Science is a special way of looking at the universe, including everything in our daily lives.		
B. Different processes and characteristics provide scientific information about objects and events.		
1. Facts and generalizations gathered and recorded in the past form a body of scientific knowledge.	EIII.D-1 S3.4.0	Gather needed information generated by others from a variety of sources appropriate to the student's ability.

2. Trial and error methods, observations, and experience suggest ideas that may be tested by controlled experiments and research.	EII.D-3 S4.1.1	Distinguish between trial and error and controlled investigations.
3. Experimentation is used to collect data and test hypotheses.	EII.D-3 S2.3.4	Design experiments to produce specific data to support or refute a hypothesis.
4. Scientific methods use a list of steps which suggest a way of collecting and testing knowledge.	S4.1.2	Match names of various processes and products of scientific inquiry with examples.
a. Make a clear statement of the problem.	EII.D-1	Identify and delineate a problem by forming questions likely to be answered through investigations.
b. Collect information.	EIII.D-1 S3.4.2 EIII.D-1 S3.4.3	Gather information from science textbooks, reference materials, science films, and television. Finds sources of information needed to solve a problem related to a specific topic.
c. Form a hypothesis.	EIIC	Develop ability to apply and evaluate data and to generate a hypothesis.
d. Test the hypothesis.	EII.D-3 EII.C-5 S1.6.1	Plan an experiment or an appropriate science investigation. Recognize the differences between fact and hypothesis. Understand the need to log only those data actually gathered.
e. Gather and record data.	EII.D-4 EII.A-2 S1.6.1	Generate, record, and organize data. Gather and interpret data by using the appropriate instruments to aid the senses in making observations. Gather own data to form own point of view, satisfying any former contradictions.
f. Analyze data	S4.1.3 EII.B-1 EII.B-2 S2.2.0	Identify and evaluate procedures in the inquiry process that have been omitted or inadequately performed. Develop ability to organize data by comparing, classifying, relating, and ordering.

g. Accept or reject hypothesis based on experimentation	EII.D-5	Analyze, evaluate, and interpret data, reaching a judgment about a situation.
	EII.A-3	Determine the need to repeat observations as a means of improving reliability and verifying data.
h. Record and communicate results.	EIII.F-1 S3.6.2	Explain, either orally or in writing, the methods and procedures involved in carrying out an investigation.
	S1.6.3	Assume responsibility for reporting results in an honest and objective manner.
5. The nature of the problem determines the methods used to seek solutions.	S1.5.1	Recognize the alternative factors to be considered when examining possible solutions.
II. Science is part of everyday life experiences.	EIV.A-2 S4.3.0	Demonstrate knowledge of relationships between science and society.
A. Curiosity about common events leads to scientific explorations.	EIV.A-4 S1.1.1	Show willingness to examine and organize objects and events in the environment.
B. Science explains many common observable phenomena.	EIV.A-1	Examine unfamiliar objects and events carefully.
	EIV.B-3	Show evidence of enthusiasm when observing scientific phenomenon.
C. Observable fact may be distinguished from opinions.	S1.7.0	Have a critical, questioning attitude toward inferences, hypotheses, and theories.
D. Scientific achievements improve our daily lives.	EIV.J-1	Value the scientific contributions of human beings from varied cultural backgrounds.
	EIV.J-2	Recognize that cultures throughout the world have contributed to the growth of scientific knowledge.
III. Science is an advancing frontier.		
A. Scientific explorations open new areas for study.		
1. Space technology provides many advances in other areas and improves the quality of life.	S4.3.1	Give examples of ways in which the use of scientific knowledge has affected society.
	EIV.J-1 S4.8.17	Cite some of the accomplishments in humankind's exploration of space.

2. Understanding that the ocean frontier influences the quality of future life on the planet.	EI.B-11 S1.3.2	Appreciate the interdependence of living organisms in the natural environment and the implications for continued survival.
B. Future advancements in science and technology are interdependent.	S4.3.2	Describe aspects of society that tend to encourage or inhibit the advancement of science.
1. Modern inventions are developed through scientific achievements.		
2. Scientists require technical equipment to gain new knowledge through extending the senses.		
IV. Science utilizes systems to group together related objects or events which have certain properties or functions.		
A. Related objects or parts comprise a system.	EI.E-1	Identify some specific properties, boundaries, and functions of a system.
1. ecosystems		
2. biological systems		
3. solar systems		
4. computer systems		
5. classification systems		
B. A model of a system provides visual materials to aid understanding.	EI.E-2	Design a model to provide a possible explanation of how a system functions, such as in a solar system.
C. Interaction takes place between objects within a system.	EI.E-3	Describe how some objects within a system interact, such as in chemical systems and electric circuits.
D. When one system is part of another, it is called a subsystem.	EI.E-4	Identify one or more subsystems within a system, such as the earth/moon subsystem within the solar system.

UNIT TWO: THE SCIENTIST

Representative Unit Objectives

The content in Unit Two should be presented as an overview initially and then integrated into Units Four, Five, and Six as students investigate science in the specific subject areas.

The student should be able to:

- Identify and relate scientists and the current fields of science to the fundamental branches of science.
- Acquire knowledge of and analyze the multitude of science and science-related career opportunities.
- Apply the skills and processes used by a scientist and relate them to human endeavors that have greatly benefited society.

Content	Continuum Skills	
I. A scientist is any individual who utilizes the ways of a scientist to acquire knowledge and understanding.	The student should be able to:	
A. A person exhibits the ways of a scientist when he or she:		
1. Has an inquisitive mind.	EIV.A	Show evidence of curiosity.
2. Makes observations.	EII.A-1	Explore, observe, and examine objects or events using a combination of senses to collect and process data.
3. Seeks what, how, and why explanations for phenomena, in order to achieve understanding.	EI.A	Demonstrate knowledge of the processes and products of scientific inquiry.
	EIV.F S3.3.1	Make purposeful, objective observations.
	EIV.I	Apply thinking processes when investigating relationships and solutions to problems.

	EII.C-3	Predict and draw inferences from data.
	S1.6.2	Form opinions only after seeking a variety of data and ideas.
4. Plans carefully before initiating experiments.	EII.D-3	Plan an experiment or an appropriate science investigation.
5. Attempts to recognize potential variables and isolate their effects.	EI.A-2	Distinguish between trial-and-error and controlled investigations.
	S4.1.1	
	EII.D	Recognize the alternative factors to be considered when seeking explanations about events.
	S1.5.1	
6. Is safety-conscious, careful, and accurate.	EIII.A-1	Select and manipulate science materials and equipment in a safe manner.
	EIII.A-2	Follow directions and safety procedures in classroom and individual laboratory investigations.
7. Respects the judgment of experts.	EIII.C-6	Seek and evaluate explanatory ideas of others.
	EIII.D	Gather data and ideas, using reading skills.
8. Recognizes that we live in a world of cause-and-effect relationships.	S4.2.1	Identify simple cause-effect relationships.
	EIV.B-2	Seek opportunities to share ideas with other persons about the relationships within the universe, including the immediate environment.
9. Makes conclusions based upon evidence.	EII.C-4	Evaluate consistency and accuracy of data obtained.
	EII.A-3	Determine the need to repeat observations as a means of improving reliability.
	S2.1.2	
	EII.D-5	Analyze, evaluate, and interpret data, reaching a judgment about situations or events.
	EIV.H-1	Point out contradictions between data and conclusions.
10. Organizes and reports results of scientific investigations in an honest and objective manner.	EIV.F-1	Report data and ideas willingly.
	EII.B-3	Develop ability to communicate data.
	EIII.E	Record, organize, and present data and ideas, using mathematical skills.
B. Scientists are human beings, members of society who specialize in the study and application of science.		

1. The word "scientist" was first created in the year 1840.

2. Ninety percent of all the scientists who ever lived are alive today.

3. Scientists represent men and women of every race and nationality.

EIV.J Value science as an endeavor of human beings from all racial, ethnic, and cultural backgrounds.

4. The public view of scientists reflects scientific advancements and contributions.

EIV.J-1 S1.9.1 Choose to gather information and report on the contributions of all cultures to the scientifc world.

5. The Nobel prizes recognize and reward scientists who "shall have conferred the greatest benefit on mankind... with no consideration given to the nationality of the candidates".

S1.9.2 Acknowledge that race, sex, or nationality should not constitute a barrier to scientific study.

C. Scientists of today are specialists who have refined and built upon the body of knowledge compiled by the many classical branches of science.

EIV.K-1 Show respect for the many science-related careers of people in our society.

1. Scientists who study matter and energy are involved in:

   a. Chemistry, which is the study of matter and its changes.

   b. Physics, which is the study of the interactions of matter and energy.

2. Scientists who study organisms are involved in:

   a. Botany, which is the scientific study of plants.

   b. Zoology, which is the scientific study of animal life.

   c. Biology, which encompasses both botany and zoology, a study of all living things.

   d. Psychology, which is the scientific study of human behavior.

   e. Ecology, which is the scientific study of the relationships between living things and their environment.

   f. Microbiology, which is the scientific study of living microscopic organisms.

3. Scientists who study the universe are involved in:

   a. Astronomy, which is the study of stars, planets, and all other objects in space.

   b. Geology, which is the scientific study of the earth.

c. Space science, and include astronauts, scientists who travel beyond the earth's atmosphere.

4. Others who work in science-related fields are involved in mathematics, which is the scientific study of numbers and their relationships. It is both a science and a primary tool of the scientists.

D. Scientists, as well as students, utilize library research skills in order to locate specific names and contributions of notable scientists.

1. Science texts and encyclopedias identify founders of the various branches of science and summarize their contributions.

EIII.D-1 Select and use science textbooks, reading references, and audiovisual materials.
S4.5.1 Match significant discoveries to persons responsible for them.

2. Professional association publications, magazines, and newspapers are sources of information about recent developments in the fields of science.

EIII.D Find sources of information needed to solve a problem related to a specific topic.

E. Students considering science and science-related careers need to consider attitudes, abilities, training, and formal education required.

1. Students anticipating possible careers in science should plan realistically and research science-related opportunities.

EIV.K-1 Show respect for the many science-related careers of people in our society.
S4.4.1 Compare the work performed by persons in science-related occupations.
S4.4.2 Identify ways in which careers are science-related.

	S1.10.1	Value the abilities, interests, and preparation required for a science-related career.
2. Scientific literacy is critical to our society in all careers. An ability to make educated decisions about the benefits, hazards, and/or risks of food additives, pollution, pesticides, and future alternatives to fossil fuel is essential.	EIV.C-3	Show appreciation of both the interdependence of living organisms in the natural environment and the implications of that interdependence for their continued survival.
	EIV.D-1 S1.4.1	Practice conservation in use of food, energy, and materials.
	EIV.D-2	Show concern and responsibility for conserving human and natural resources.
	EIV.E S2.3.1	Examine environmental issues, pointing out contradictions and discrepancies in the positions of various groups.

UNIT THREE: TOOLS AND TECHNIQUES OF SCIENCE

Representative Unit Objectives

The content in Unit Three should be presented as an overview intially and integrated into Units Four, Five, and Six as students investigate science in the specific subject areas.

The student should be able to:

- Utilize scientific equipment and apparatus in an appropriate manner.
- Develop scientific vocabulary, viewing such vocabulary as an efficient means of effective communication.
- Use basic measurements in the (SI) metric system as a basis for scientific commonality and accuracy of quantitative measurements.

Content	Continuum Skills	
I. Tools and Techniques of the Scientists	The student should be able to:	
A. Students are utilizing the techniques of science when they:		
1. Use a scientific method to make and record purposeful observations, accurately generate and organize data, form hypotheses, and evaluate results to predict, generalize, explain and judge scientific ideas.	EII.A	Develop ability to generate data.
	EII.B	Develop ability to organize and report data.
	EII.C	Develop ability to apply and evaluate data and to generate hypotheses.
	EII.D	Participate in scientific inquiry at the appropriate level.
	EII.D-5	Gather own data to form own point of view, satisfying any former contradictions.
	EIV.F	Organize and report results of scientific investigations in an honest and objective manner.
	EIV.H	Have a critical questioning attitude toward inferences, hypotheses, and theories.
2. Use instruments, as needed, to extend the limit of their senses and improve the accuracy of observations.	EIII.A-1	Select and manipulate science materials and equipment in a safe manner.

	EII.A-2	Gather and interpret data by using the appropriate instruments to aid the senses in making observations.
3. Develop the ability to organize information by comparing, classifying, and ordering.	EII.B-1 EII.B-2	Develop and use various classification systems. Organize materials in a serial or sequential form.
4. Participate in scientific inquiry at the appropriate level.	EII.D-1	Identify and delineate a problem by forming questions likely to be answered through investigation.
	EII.D-4	Generate, record, and organize data.
5. Increase their scientific vocabulary in order to more effectively and efficiently describe phenomena and to exchange information that is clear, concise, and commonly understood.	EII.A-4	Identify the names of objects and sequences of events.
	EIII.F-2	Develop a science vocabulary.
B. The metric system (SI) is a measurement system used by all scientists and most countries throughout the world.		
1. The metric system offers three advantages.	EIII.E-4	Use S.I. metric and English systems effectively.
a. Fractional units in the metric system facilitate accuracy.	S2.1.3	Use measurement procedures to improve accuracy of observations.
b. The metric system is based on fractional units of tenths or hundredths, allowing for easy conversion of fractions to decimals.		
c. The metric system is universally understood.		

2.	Appropriate units exist in the metric system to express length, volume, and mass.		
	a. Parameters of the measurement task determine the appropriate metric unit and prefix to be used in each situation.		
	b. Units of length are based on the meter and are expressed as millimeters, centimeters, meters, and kilometers.	S3.7.2	Measure linear distances, using a metric ruler.
	c. Units of volume are based on the liter and are commonly expressed as milliliters and liters.	S3.7.4	Measure volume of liquids in a graduated cylinder marked in metric units.
	d. Units of mass (weight) are based on the gram and may be expressed in both grams and kilograms, where appropriate.	S3.7.1 S3.7.3	Count, use numbers, and balance objects on an equal-arm balance scale. Use a balance to determine the mass of objects.
3.	Mathematics and measurement are important tools of scientists. Selecting and applying appropriate mathematical concepts and skills are needed in order to interpret data and solve problems.	EIII.E S3.5.2 EIII.E-1 S3.5.3	Record, organize, and present data and ideas. using mathematical skills. Tabulate information and use tables. Interpret graphs and display data graphically.
C.	Scientists and students of science assemble and use laboratory apparatus, tools, and materials skillfully and safely.	EII.A-2 EIII.E-2	Gather and interpret data by using the appropriate instruments to aid the senses in making observations. Use mathematical tools in manipulating data and solving problems.

UNIT FOUR: MATTER, ENERGY, AND RESOURCES

Representative Unit Objectives

Different textbook and nontextbook programs may emphasize various processes, facts, and concepts. Teachers should emphasize those components of the outline exemplified in programs used in the classroom and select the activities most appropriate to the needs of the students.

The student should be able to:

- Investigate and identify the distinguishing characteristics of matter and energy.
- Investigate and provide examples of the effects of energy upon matter.
- Investigate and demonstrate an appreciation of the relationships between the interchangeability of the forms of energy and the search for energy alternatives to fossil fuels.

Content	Continuum Skills	
I. Matter exists in various forms which have specific properties.	The student should be able to:	
A. Matter consists of particles.		
1. Matter is anything that has mass (weight) and takes up space (volume).	EI.C-2	Identify and classify matter by its physical properties (such as solid, liquid, or gas) or by its chemical properties, including its smallest particles, called atoms.
2. Elements can mix or combine to form compounds producing most of the common forms of matter.	EI.C-4 S4.2.7	Describe interaction and reorganization of units of matter and their association with changes of energy such as in the rusting of steel wool.
3. There are about 90 natural elements.		
4. All elements are composed of three basic particles called protons, neutrons, and electrons.	EI.C-5 S4.2.3	Discuss or construct a model illustrating how atoms are composed of electrons, protons, neutrons, and other particles.

B. Each kind of matter may be identified and classified by its characteristic physical and chemical properties.		
1. Examples of physical properties are size, shape, color, and melting and freezing points.	EI.C-3 S2.1.4	Identify changes and rates of change in properties, such as in rock decomposing into soil.
2. Chemical properties relate to the abilities of materials to combine.	EI.C-4	Explain that a chemical change is a change in the molecular structure of matter, such as in burning sugar.
3. Mixtures and solutions are substances put together, but not chemically combined.	EI.C-3	Investigate physical changes in size, shape, or state of matter, such as in water vapor in clouds condensing to produce rains or filtering water to remove impurities.
4. Acids and bases are chemical compounds.	EI.C-2	Identify and classify matter by its chemical properties, such as in acids tasting sour and bases tasting bitter and feeling slippery (when tasting and touching are safe) and in the color changes of litmus paper caused by an acid or base.
C. A physical change is a change in the size, shape, or state of matter.		
1. In physical change, the chemical formula of each substance remains the same.	EI.C-3 S4.8.20	Demonstrate that in physical changes the total amount of matter remains unchanged by using grinding, breaking, wrinkling, and dissolving as examples.
2. Solid, liquid, and gas are the three basic states of matter.	EI.C-1	Perform an investigation to establish that matter exists as solids, liquids, and gases. Investigate how physical conditions of temperature determine in which of the states of matter a substance will be found.
D. A chemical change is a change in the molecular structure of matter.		
1. Reactions take place resulting in new materials being formed.	EI.C-4	Investigate that a chemical change is a change in the molecular structure of matter such as results from the combining of soda and vinegar.
2. Substances formed by chemical change have different properties.		

II. Energy exists in various forms which have specific properties.		
A. There are two states of energy.		
1. Potential energy is energy in a stored condition.	S4.2.9	Identify examples of potential energy. Fossil fuels and wood provide examples of stored chemical potential energy that can be converted into heat and light; water in reservoirs has the potential for conversion to hydroelectric power.
2. Kinetic energy is the energy of an object in motion or undergoing chemical change.	S4.2.9	Identify examples of kinetic energy such as moving balls or electrons.
B. There are various forms of energy, including heat, light, electricity, sound, mechanical, muscular, chemical, and magnetic.	EI.C-6	Demonstrate various forms of energy through activities such as producing an electric current using copper, zinc, and a weak acid.
C. Energy may be changed from one form to another.	EI.C-7	Perform investigations to provide evidence of energy changing from one form to another such as occurs when a candle burns, converting chemical energy to heat energy.
D. Energy must be applied to do work.	EI.C-8	Understand the definitions and interrelationships of force, work, and energy. Identify examples of applying energy to do work such as adding heat energy to warm a cold room, exposing camera film to a controlled amount of light, and pushing a car.
E. There are relationships between matter and energy.		
1. Energy can be used to change matter from one state to another.	EI.C-1 S4.2.7	Describe interaction and reorganization of units of matter and their association with changes of energy. Investigate a physical change such as occurs when heat energy changes a solid (ice) to a liquid (water).

2. On earth, living things have an important part in the relationship between matter and energy. a. Plant and animal life provide chemical energy and decompose to form fossil fuels. b. Living things use both matter and energy to change their forms as part of the life processes.	EI.E-6 EI.B-10 S4.8.7	Investigate ways that living organisms utilize matter and return it to the environment, as in photosynthesis and decomposition.
3. Matter and energy can be changed from one form to another, but the sum of matter and energy remains the same.	S4.8.20 EI.E-7 S4.8.21	Demonstrate that in chemical or physical changes the total amount of matter remains unchanged. Recognize that in nuclear reactions a loss of matter is a gain in energy; the sum of matter and energy remains constant.
4. Interaction of matter and energy occurs in nonliving things.	EI.E-8	Investigate the interaction of matter and energy in nonliving things such as occurs between water and heat in the water cycle.
F. Our nation depends on fuels as the source of chemical energy.	S4.2.8	Recognize the uses of fuels.
1. Our country is seeking alternate sources of energy.	EIV.D-2	Show concern and responsibility for conserving human and natural resources.
2. Fossil fuels are limited resources.	EIV.D-1	Practice conservation in use of food, energy, and materials.
3. Nuclear power plants, solar cells, wind-powered generators, and geothermal energy are possible alternatives to fossil fuels like gas and oil.	EIV.E-1 EIV.H-2 EIV.E S4.8.25	Consider possible resolutions to some problems. Show willingness to change ideas in the light of new evidence. Develop and express an opinion on a social issue. Recognize the value of using renewable instead of nonrenewable energy sources.

UNIT FIVE: ORGANISMS AND THE ENVIRONMENT

Representative Unit Objectives

Different textbook and nontextbook programs may emphasize various processes, facts, and concepts. Teachers should emphasize those components of the outline exemplified in programs used in the classroom and select the activities most appropriate to the needs of the students.

The student should be able to:

- Investigate and identify the characteristics distinguishing living from nonliving organisms.
- Investigate and classify living things by their observable characteristics.
- Investigate and appreciate the interdependence of humankind with all other living organisms.
- Describe examples of an organism's adaptation to its environment.

Content	Continuum Skills	
I. Each type of organism has adapted to specific conditions for life.	The student should be able to:	
A. There are characteristics that distinguish living from non-living.	EI.B-7 S4.8.2	Recognize that all living organisms have the same life processes by investigating a variety of plants and animals.
1. The cell is the microscopic unit of structure basic to most living beings.	EI.B-4 S4.8.1	Investigate the cell, the basic unit of structure and function of a living organism.
a. Plant and animal cells have similar and different characteristics.		
b. Organisms may be single or multicellular.		
c. Multicelled organisms contain specialized cells.		

B. Living things use energy, reproduce their own kind, respond to the environment, and have similar life processes.	EI.D-10 S.4.8.5	Recognize that the sun is the source of energy for green plants and is basic to the growth and maintenance of living organisms by investigating food webs.
C. Living things are interdependent.		
1. Living organisms interact in a variety of ways.	EI.B-2	Explain how plants and animals are interdependent, including photosynthesis and the oxygen cycle.
a. Living organisms utilize the food sources and territory in an ecosystem.	EI.B-10	Describe how living things capture matter and energy from the environment and return them to the environment; this involves food chains, photosynthesis, and decaying in the nitrogen cycle.
2. Communities of plants and animals living together in an environment influence each other.	EI.B-2	Demonstrate the interdependence of plants and animals with the environment.
a. Some organisms live together for mutual benefit.		
b. Food chains and webs illustrate the links between different food consumers in a community.	EI.D-10	Identify the sun as the source of energy for life on earth by investigating food chains and webs.
c. Ecosystems demonstrate the interdependence of plants and animals with the environment.	EI.B-8	Describe cycles in an ecosystem which illustrate the interdependence of organisms such as in the oxygen cycle.
3. Each organism is adapted by structure, function, and behavior to its environment.	EI.B-3 S4.8.11	Understand relationships of structure and function of living organisms to their environment by investigating how plants and animals survive in areas such as water, land, warm or cold regions.
a. Living things vary in different geographical locations.	S4.8.4	Understand and describe living organisms that grow and develop in different environments.
b. Organisms interact with the environment, and environmental factors determine survival.	EI.B-9	Explain how the environment affects the survival of organisms through adaptation.

c. Physical factors of an environment and the characteristics of life forms determine the organisms which can live in a specific environment.	EI.B-3 S4.8.9	Recognize that a living organism is a product of its heredity and environment by investigating plants and animals which live in different environments.
4. Organisms may be classified by similarities and differences in characteristics.	EI.B-5	Classify organisms such as viruses, bacteria or varieties of plants and animals by similarities and differences in characteristics.
a. Scientists have classified all living things as plant, animal, or protist.		
b. Classification systems aid identification of organisms and increase understanding of similarities observable in living organisms.	S4.2.12	Recognize that classification systems are developed by humans and are one way of helping to understand the basic organization and pattern of nature.
5. Organisms have similar functions.	EI.B-6	Explain that living organisms have similar functions such as reproduction and oxidation of food.
a. Living organisms reproduce their own kind.	EI.B-7	Explain that every plant and animal species has a life cycle in which the same pattern of development is repeated from generation to generation.
b. Organisms utilize resources and eliminate wastes.	EI.B-10	Discuss how living things capture matter and energy from the environment and return them to the environment such as in green plants obtaining minerals from the soil.
c. Living things use matter and energy to function.		
6. Every species has a life cycle in which the same pattern of development is repeated from generation to generation.	EI.B-7	Recognize that a living organism is a product of its heredity and environment.
II. There is continuous exchange of matter and energy between organisms and their environment.		

A. There are many cycles in the ecosystem.	EI.B-8	Describe cycles such as water, oxygen, nitrogen, and food chains which include decomposition by bacteria to soil.
B. The environment affects the survival of organisms.		
1. Changes in organisms allow the best adapted organisms to survive.	EI.B-9 S4.8.12	Recognize that living organisms have changed over the ages and that some species are now extinct.
2. Conditions for life on earth have changed in the past and will continue to change.		
C. Living things capture matter and energy from the environment and return them to the environment.	EI.B-10 S4.8.7	Recognize that living organisms utilize matter and return it to the environment by investigating respiration and ingestion of food and elimination of wastes.
D. Organisms affect the environment.	EI.B-11	Discuss how organisms affect the environment in many ways such as people building structures or polluting the air, animal over-grazing of an area, or plants holding soil to prevent erosion.

UNIT SIX: THE UNIVERSE

Representative Unit Objectives

Different textbook and nontextbook programs may emphasize various processes, facts, and concepts. Teachers should emphasize those components of the outline exemplified in programs used in the classroom and select the activities most appropriate to the needs of the students.

The student should be able to:

- Investigate and demonstrate an understanding of the ordered interrelationships of objects in our solar system and the known universe.

- Investigate forces which influence patterns in space and create change.

Content	Continuum Skills	
I. Order and change exist in the universe.	The student should be able to:	
A. There are many kinds of objects in space.	EI.D-1 S4.8.16	Demonstrate knowledge of basic differences between planets, stars, the solar system, the Milky Way Galaxy, and the known universe.
1. Natural objects include galaxies, stars, and planets.		
2. Objects like rockets, satellites, and space debris move in space.	S4.8.17	Cite some of the accomplishments in humankind's explorations of space.
B. The relationships between the earth and the sun affect the environment.	EI.D-2 S4.8.6	Investigate the importance of energy levels as related to ecosystems in such areas as plants, animals, and weather.
1. Changes in daylight and darkness result from the earth's rotation and revolution.		
2. The angle of the sun's rays causes seasonal changes on earth.		
C. As the earth rotates on its axis, it revolves around the sun.	EI.D-3 S4.8.14	Describe and show evidence of the regular movements of the earth and moon such as day and night and the seasons.

1.	The earth follows a predictable orbit around the sun.		
2.	The earth's axis maintains a fixed angle.		
D.	The moon is the natural satellite of the earth.	EI.D-3	Describe the regular movements of earth and moon.
1.	Solar and lunar eclipses occur as the result of the relative positions of the sun, the moon, and the earth.	EI.D-4 S4.8.14	Design a model to demonstrate solar and lunar eclipses and phases of the moon.
2.	The changing position of the moon in relation to the sun and sunlight produces the phases of the moon.		
II.	There are patterns in the universe.		
A.	The motions of objects in space can be predicted.	EI.D-5 S4.8.13	Demonstrate that the motion and path of celestial bodies are predictable. Use planetarium and maps to explain orbits and positions of objects in space.
1.	The nine known planets move in predictable orbits around the sun.		
2.	The position of stars in the Milky Way can be identified and mapped.		
3.	Constellations help to locate stars.	S1.8.1	Describe an interesting object or event in space.
B.	Conditions for life are affected by available sunlight.	EI.D-6 S4.8.6	Describe the importance of energy levels as related to ecosystems.
1.	Radiant energy from the sun provides light and heat for the earth.	EI.D-10	Identify the sun as the source of energy, including food, heat, and light, making possible life on earth.
2.	The sun affects atmospheric and magnetic conditions on earth.		

3. The earth's atmosphere, the angle of the earth's axis, and altitude all determine the amount of sunlight reaching specific geographical areas on the surface of the earth.	EI.D-13	Investigate how the atmosphere, including cloud covering and pollution, affects the amount of solar energy reaching the earth.
4. Conditions on other planets in our solar system are different from those on earth.		
C. There is continuous interaction between matter and energy throughout the universe.	EI.E-7	Explain that matter and energy can be changed from one form to another in processes such as fusion.
1. Fusion converts matter in stars, including the sun, to energy.	S4.8.30	Explain the definitions and interrelationships of force, work, and energy.
2. Sunspots on the surface of the sun alter the earth's magnetic field.		
III. There are several forces active in the universe.		
A. Gravity and momentum affect the relationships of objects in space.	EI.D-8	Demonstrate how gravitational attraction affects objects in space, including planets in orbit. Explain how similar forces affect tides on earth.
1. Gravity is an attraction between objects resulting from their masses.		
2. The gravitational attraction of the sun upon the planets and their momentum combine to hold the planets in their respective orbits.		
3. The moon and sun's gravitational attraction on the earth causes tides.	S4.8.18	Demonstrate knowldge of the effects of moon and sun on tides.
B. Astronomers use a variety of instruments in investigating changes in the universe.	EII.A-2	Gather and interpret data by using the appropriate instruments to aid the senses in making observations. Investigate how lenses and prisms have aided in the study of the universe.

	1. Telescopes improve observations of space.		
	2. Spectrascopes separate light into colors to detect elements present in stars.		
C.	The sun is the source of energy for life on earth.	EI.D-10	Demonstrate how the sun is the source of energy, including heat, light, and food, for life on earth.
	1. Most forms of energy are derived from the sun.	S4.8.25	Explore the values of using renewable instead of nonrenewable energy sources.
	2. Living organisms utilize energy from the sun.		
D.	The amounts of the sun's energy absorbed by land, water, and air affect weather and climate.	EI.D-11 S4.8.26	Identify major factors that cause weather changes and patterns. Investigate heat absorption and retention by soil, water, and air.
	1. The sun causes the waters of the earth to evaporate and creates the water cycle.	EI.C-1 S4.8.28	Identify the ocean as a major influence on weather. Investigate how physical conditions of temperature and pressure determine in which of the states of matter (solid, liquid, or gas) a substance will be found. Design a model to demonstrate the water cycle.
	2. Warming air rises to produce air currents.		
	3. Climate zones are caused by many factors, including the position of the earth in relationship to the sun, large bodies of water, and mountains.		
E.	The earth's surface is in continuous change.	EI.D-12 S4.8.22	Identify evidence that there are continuous changes on earth such as those caused by erosion and earthquakes. Design investigations and experiments on various types of erosion such as the effects of abrasion, heat, and chemical changes. Design a model to illustrate the formation of mountains.

	1. The earth has a history of change.		
	2. The earth's surface is constantly being built up.		
	3. Forces continually wear away at the surface of the earth.		
F.	The atmosphere affects the amount of solar energy reaching the earth.	EI.D-13	Investigate how the atmosphere affects the amount of solar energy reaching the earth and the amount of heat trapped by the air.
	1. Various layers of the atmosphere have been identified.		
	2. Layers in the atmosphere affect the radiation that reaches the earth.		
	3. Pollutants alter the earth's atmosphere.	EI.B-11 S4.8.8	Describe examples of humankind's dependence on and interference with natural ecosystems.
G.	Solar energy can be converted into other forms of energy.	EI.C-7	Demonstrate how energy can be changed from one form to another, including from radiant to heat energy.
	1. Many currently utilized sources of energy have the sun as the initial source of energy, forming a solar energy chain.		
	2. Solar energy is an energy source which can heat water and can be converted to electricity. It has significant potential for the future.	S4.8.25	Recognize the value of using renewable instead of nonrenewable energy sources.
H.	Light and matter interact in various ways.	EI.D-15	Identify various ways that light and matter interact, such as sunlight reflecting from the moon or light passing through a prism and forming a spectrum. Demonstrate the interaction of light and objects in such subjects as photography and photosynthesis. The photoelectric cell, radiometer, and solar cell may be used for investigative purposes.

1. The eye is an organ that receives and focuses light.

2. Objects may reflect, absorb, transmit, or refract light.

SAMPLE TEACHER-DIRECTED LESSON

Subject: Science 6

Representative Objective: Student identification of physical and chemical changes in matter

1. Specific Objective

   The student will identify changes in physical and chemical properties involving various materials.

   The student will describe interaction and reorganization of various materials and their association with energy changes.

2. Rationale/Value

   Everything in our daily lives is subject to change. Some changes involve the size of particles or the reorganization of matter without changing its chemical nature or formula. Other changes involve forming new chemicals from other substances. Students will develop an understanding of how these changes occur and how the rates of change are interrelated with the kinds of matter involved, the sizes of particles, and temperature.

3. Initial Instruction

   Materials required for teacher demonstration:

   - wood strips
   - paper
   - ice
   - graduated flask
   - marbles to fill flask
   - sand
   - hot plate or burner
   - 125 grams copper sulfate
   - one liter beaker
   - mortar and pestle
   - water

   CAUTION: copper sulfate is poisonous and is recommended for teacher demonstration only at elementary grades.

   Using the materials provided, the teacher will:

   a. Review through teacher demonstrations characteristics of chemical and physical changes.

      1. Demonstrate examples of physical change such as occur in breaking wood, wrinkling paper, melting ice, and pulverizing copper sulfate with a mortar and pestle.

      2. Demonstrate examples of chemical change such as occur in rusting, rotting, and burning.

      3. Discuss the differences between physical and chemical changes; for example, in physical change the formula of the materials remains the same, and in chemical change a new material is formed.

b. Apply knowledge of physical and chemical change by dissolving a substance in a liquid.

1. Dissolve sugar in hot water. For a demonstration to help understand the physical change that takes place in dissolving sugar in water, fill a flask with marbles. Place sand in the flask so some of the marbles are covered. Compare the dissolving sugar in water with the flask of marbles and sand. The sugar breaks down into small enough particles (sand) to fit in between the water molecules (marbles). In this investigation of physical change none of the sugar combines with the water molecules, just as in the demonstration none of the sand combines with the marbles.

2. Heat a liter of water to boiling. Remove from heat and dissolve 125 grams of copper sulfate in the hot water. This is an example of a physical change. This solution will be used in the following investigation.

4. Guided Group Practice

Materials required:

- two iron nails, nongalvanized
- nonwaxed drinking cup or beaker
- one liter of water at room-temperature
- copper sulfate solution (125 g/l) at room temperature
- hot copper sulfate solution used for preceding demonstration

Using the materials provided, students will observe a chemical change.

This investigation is appropriate for teacher demonstration. Place two nails in the cup or beaker so that they lean or stand in the container. Fill half the cup with the hot copper sulfate solution and the remaining half with copper sulfate solution which is at room temperature. Do not totally submerge the nails. In this chemical change the students will observe copper, a new material, being formed on the nail. As the iron in the nail and the copper in the solution trade places, the solution will also turn a different color. This color change in the solution, from blue to yellow, will be apparent by the next day.

Students should record observations by completing the table on the activity sheet.

Students may select terms such as: silvery, copper-colored, reddish-brown, blue, green, yellow, faster, slower, etc.

HOW DO THE COPPER SULFATE SOLUTION AND NAILS INTERACT?

SOLUTION	COLOR OF NAIL		COLOR OF SOLUTION		RATE OF REACTION
	before	after	before	next day	
HOT COPPER SULFATE					
ROOM-TEMPERATURE COPPER SULFATE					

After completion of the table, students may discuss their ideas regarding why the reaction occurred and the reason for the difference in rates.

5. Independent Practice

Students draw a sketch, labeling each part of the investigation of the nails in copper sulfate solution, and write a brief description of their observations including:

a. Nails in the beaker
b. Copper sulfate solution in the beaker
c. Materials collecting on the nail
d. Temperature of the solutions

Students describe examples of physical and chemical changes.

6. Alternate Activity

Place a nail in water. Observe rust on the nail. Describe the chemical change.

7. Supplemental Activities

Use chemical equations to explain changes.

Write a report on the importance of corrosion of metals and the ways used to prevent or retard it.

8. Evaluation

Review students' completion of the activity sheet.
Assess students' information during discussion periods.
Provide a teacher-prepared quiz.

TEACHING STRATEGIES

A variety of instructional strategies can enhance the students' growth in concept and skill development. Examples of these instructional strategies include:

- Teacher-directed lesson with the class investigating the same problem.

- Teacher demonstration with the class observing and recording observations and data.

- Independent study. Students conduct independent research and study concept or process areas. When completed, such individual work provides a basis for class learning projects.

- Team learning situations wherein two to four students function together as a laboratory investigation group. Interaction within and among groups acts both as a stimulus and an information-sharing aid to learning.

- Grouping of lower achieving students with those achieving at a higher level. This permits peer tutoring and interaction which can benefit the less motivated individuals.

- Contract between student and teacher which outlines and prescribes specific tasks to be performed by the student for the fulfillment of certain course requirements.

- Self-paced learning designed for mastery. Assessment is conducted as each student concludes each unit, and the results indicate whether a student is ready to advance to the next unit or experience--a repeated opportunity for the instructor to use a new strategy. Student's mark is based on number of units mastered.

- Library research studies wherein many of the principles learned in laboratory and class activities can be applied to a class, small group (team), or individual project.

- Class presentations by individual or laboratory teams on the outcomes of laboratory investigations which are shared with the class.

- Design and formulation of research projects. Individuals or teams apply the methods, material, and techniques learned to a real experimental investigation.

EVALUATION PROCEDURES

The evaluation of instruction is an integral part of the educational process. It provides information on what has been accomplished and where to go next. The first phase of evaluation should be diagnostic. The teacher should assess what students know before instruction, and then plan an appropriate course of instruction based on students knowledge and abilities. In addition to diagnostic pretesting, ongoing evaluation during instruction provides teachers with a record of student progress and indicates the instructional changes that may have to be made in order to plan for maximum achievement. Post-testing assesses how well students have met the objectives at the end of the unit or course. The Elementary and Secondary Science Continuums provide teachers with a basis for the development and implementation of instructional objectives.

The selection or construction of appropriate instruments of evaluation is critical to the measurement process. Test items must measure and reflect instructional objectives. Tests of achievement and problem-solving skills often require advanced reading skills. Therefore, it is recommended that diagrams, graphs, and pictures also be used to evaluate student progress and achievement.

Various measures of evaluation can be used in all phases of science education. Achievement tests assess science knowledge and comprehension. Problem-solving measures are useful for measuring higher cognitive skills such as analysis, synthesis, and evaluation. Motor skills and skill in the application of scientific knowledge can be evaluated in the laboratory setting. Observation and interview techniques are useful in the assessment of such laboratory skills as manipulating of materials, setting up experiments, handling and caring for live specimens, and employing safety practices. These measurement techniques allow for immediate feedback to students.

Suggested assessment procedures include the following: teacher-prepared tests; commercially-prepared tests; departmental tests; informal and formal assessment of individual and group activities in oral as well as written work and discussion; and student-prepared test items which provide reinforcement and the opportunity to apply course content.

TIPS FOR PARENTS

There are many ways in which parents can provide the proper guidance, motivation, assistance, and a nurturing home environment for their youngster's success and learning in science.

1. Show an active interest in your youngster's science learning activities. Take notice of and respond to science-related conversations, books, magazine and newspaper articles.

2. Be an observer. Offer assistance with a statement like, "We can discover by observation." This will stimulate and help your youngster to understand how knowledge develops through observation, thought, exploration, and verification.

3. Be a good listener, and discuss science interests and questions. This will help you learn more about your youngster's interests, thinking and reasoning abilities, and attitudes.

4. Read, review, and discuss homework and other class assignments.

5. Share experiences. For example, if you are an amateur gardener, mechanically inclined, a rock and mineral collector, etc., then you have something to share and to contribute to your youngster's developing curiosity about scientific interests.

6. Learn together. Encourage questions. Help your youngster locate sources of information and plan activities that provide opportunities for observing, experimenting, and recording data and the results of experimentation.

7. Practice scientific skills and attitudes. For example, help your youngster learn to withhold judgments until sufficient evidence has been secured, to challenge sources of information, and to be open-minded. These efforts will lead students toward the attainment of productive scientific attitudes.

8. Provide a quiet work and study area which can be used for homework and study, developing collections, experimenting, and making things.

9. Provide materials for learning, such as science-related books and magazines. Not only do they help students answer questions, but they also provide opportunities to experience the satisfaction of independent discovery.

10. Plan visits to museums, science fairs, observatories, zoos, national parks, open houses at universities, industry and governmental agencies, and other places of scientific interest.

11. Discuss with the teacher your youngster's progress and the specific learning needs which can be met through home study, and how your youngster might receive individualized help if needed.

12. Consult with the teacher and librarian about the selection of science-related books, magazines, and other materials available for reading. Become familiar with some of the science apparatus, displays, books, audiovisual, and other instructional materials used by the school.

13. Learn about the school's science program. Parental support of the school program is an essential factor in shaping positive attitudes toward education.

APPENDIXES

APPENDIX A

RESOURCES

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Aprendiendo Sobre Animales (work sheets, Spanish edition). Los Angeles Unified School District: Office of Instruction. Zoomobile Model Dissemination Project. Available from Zoomobile Model Dissemination Project.

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Aquarium Classroom Kit. Los Angeles Unified School District: Office of Elementary Instruction. Science Center Order Form. Available from Regional Science Centers.

Audiovisual Materials Resource List, Secondary Schools Edition. Latest Revision. Los Angeles Unified School District: Audiovisual Services Section.

Balancing Objects Kit: Metric Weights and Measures. Los Angeles Unified School District: Office of Elementary Instruction. Science Center Order Form. Available from Regional Science Centers.

Behavior of Mealworms Classroom Kit. Los Angeles Unified School District: Office of Elementary Instruction. Science Center Order Form. Available from Regional Science Centers.

Caracteristicas de Vertebrados (work sheets, Spanish edition). Los Angeles Unified School District: Office of Instruction. Zoomobile Model Dissemination Project. Available from Zoomobile Model Dissemination Project.

Catalog of Standard Equipment for Elementary, Secondary, and Adult Schools. Latest Revision. Los Angeles Unified School District: Materiel Section.

Catalog of Standard Supplies for Elementary, Secondary, and Adult Schools. Latest Revision. Los Angeles Unified School District: Materiel Section.

Conservation of Energy; Suggested Activities for Pupils. Publication No. EC-440. A set of study prints, task cards, and worksheets for pupil use; emphasis on energy forms and methods of conservation. Los Angeles Unified School District: Instructional Planning Division.

Correlations of Elementary Science Continuum With Basic Science Programs, Kindergarten - Grade Six
(Five guides)

1) Concepts in Science, 1966 Edition
   Concepts in Science, 1975 Newton Edition
   Concepts in Science, 1980 Curie Edition
2) Elementary Science Study (ESS)
3) Gateways to Science
4) Science Curriculum Improvement Study (SCIS and SCIS II)
5) Space, Time, Energy, Matter (STEM Program)

Los Angeles Unified School District: Office of Instruction, 1983

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Elementary School Curriculum: A Balanced Program. Publication No. X-107. A three-part companion volume to the revised (1979) edition of Elementary School Curriculum, EC-436. Contains skills continuums, grade charts identifying essential skills, and a teacher resource section. Los Angeles Unified School District: Office of Elementary Instruction.

Elementary Science Continuum Coded Objectives. Los Angeles Unified School District: Office of Instruction, 1983.

Essential Mastery Levels in Elementary Science Kindergarten - Grade Six. Los Angeles Unified School District: Office of Instruction. 1983

Evaluation Summary - Secondary Science Continuum Assessment, Version 1, 1979-1980, Version 2, 1982. Los Angeles Unified School District: Office of Secondary Instruction.

Floating and Sinking Things Kit. Los Angeles Unified School District: Office of Elementary Instruction. Science Center Order Form. Available from Regional Science Centers.

Flying Things Kit: Animals and Objects. Los Angeles Unified School District: Office of Elementary Instruction. Science Center Order Form. Available from Regional Science Centers.

Getting to Know Chickens (reading materials with illustrations). Los Angeles Unified School District: Office of Instruction. Zoomobile Model Dissemination Project. Available from Zoomobile Model Dessemination Project.

Getting to Know Desert Tortoise (reading materials with illustrations). Los Angeles Unified School District: Office of Instruction. Zoomobile Model Dissemination Project. Available from Zoomobile Model Dissemination Project.

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Iguana (activity sheets and audio cassette). Los Angeles Unified School District: Office of Instruction. Zoomobile Model Dissemination Project. Available from Zoomobile Model Dissemination Project.

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ELEMENTARY SCIENCE CONTINUUM

CODED OBJECTIVES

LOS ANGELES UNIFIED SCHOOL DISTRICT
Office of Instruction
1983

APPENDIX B

Science is a basic subject within the curriculum. It is viewed as a body of collected knowledge that explains the universe. It is also viewed as a set of processes and skills that can be used to acquire and compile information systematically. The dynamic relationship between systematic processes and knowledge is the essence of the scientific enterprise. In this regard, science is the acquiring and organizing of knowledge in such a way that natural phenomena are more adequately explained and their usefulness to humankind is enhanced. A major area of emphasis is the development of those values and attitudes that relate to the personal involvement of the individual with her or his environment and with all other human beings.[1]

ORGANIZATION

The Science Continuum encompasses the four competency strands of knowledge, thinking processes, skills, and attitudes. Within each strand, the continuum includes essential student objectives. However, the continuum does not limit the scope of the science curriculum. Teachers should encourage students to progress to the extent of their interests and abilities. In the continuum, certain symbols are used. Although these symbols identify specific grade-level applications, introduction and emphasis may occur at earlier grade levels.

Knowledge Strand: The goal is to assist the student in developing knowledge of processes, facts, principles, generalizations, and applications - the products of science - and to encourage their use in the interpretation of the natural environment. Acquisition of organized knowledge is a long-range goal of science and science education. Through an understanding of contributing facts, unifying principles, and relevant processes, organized knowledge gradually takes on meaning for the learner.

At all levels, the knowledge goal must be in balance with and consistent with the other components of thinking processes, skills, and attitudes. Special types of knowledge can be included within this area:

- Knowledge that enables the learner to communicate the thinking processes and skills of science
- Knowledge that constitutes broad generalizations which interrelate the many facts, concepts, and principles of all sciences
- Knowledge of how science and technology affect society
- Knowledge that constitutes the content, basic concepts, and structure of the major disciplines in science

Knowledge areas within the continuum include Organisms, Matter and Energy, and the Universe (geology, meteorology, and astronomy).

Thinking Process Strand: The goal is to help the student develop and apply rational and creative thinking processes. As defined here, these processes refer to the cognitive techniques involved in scientific inquiry as well as those which are basic to all rational thinking. Such processes as observing, measuring, comparing, and classifying lead to more sophisticated processes, such as inferring, generalizing, and theorizing.

Skills Strand: The goal is to help the student develop and use fundamental skills in the manipulation of materials and equipment; in caring for and handling living organisms; and in gathering, organizing, and communicating information relating to science. Various skills are utilized when the student employs thinking processes to develop a conceptual understanding of the natural environment and collects information through observation, manipulation of materials and apparatus, reading, listening, use of measuring instruments, and handling of living organisms. The learner employs language and mathematical skills in recording and organizing information. A major goal of science education is to provide opportunities for learners to develop and use these manipulative and communicative skills. The skills goal is not only critical to science education and learning, but it is also important to the development of competencies necessary for effective citizenship.

Attitudes Strand: The goal is to assist students in the development of values, aspirations, and attitudes which promote the personal involvement of the individual with the environment and society. The attitudes listed relate to what is hoped students will accomplish individually, through self-motivation, as a result of science instruction. Positive attitudes toward science and learning are prerequisites to effective learning in other strands. Objectives of the attitudes strand include the ability of the learner to internalize scientific attitudes; to establish the personal and social relevance of what has been learned about science, scientists, and society; and to enjoy and appreciate science.

IMPLEMENTATION

Science knowledge, processes, skills, and attitudes relate to the total curriculum of the school. Specifically, the teaching of science promotes language development by providing learners with an experiential basis for reading, writing, speaking, and listening. The nature of science stimulates motivational experiences that encourage language development.

As with language instruction, science utilizes and reinforces mathematical skills. Science instruction, with its accompanying laboratory activities, makes the use of such skills more interesting, more useful, and more applicable to "real-life" situations. Problem-solving skills and knowledge, learned in conjunction with science studies, assist the individual with decision making in everyday-life situations and lead to the goal of creating scientifically literate citizens.

[1]Adapted from *Science Framework for California Public Schools* (Sacramento: State Department of Education, 1978).

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SCIENCE GRADE CHARTS	5	6
SYMBOLS ---- = AWARENESS/EXPOSURE □ = INTRODUCTION/DEVELOPMENT ■ = MASTERY/EMPHASIS ——— = MAINTENANCE/REINFORCEMENT		
I. KNOWLEDGE		
A. DEMONSTRATES KNOWLEDGE OF THE PROCESSES AND PRODUCTS OF SCIENTIFIC INQUIRY.		
RELATIONSHIP BETWEEN KNOWLEDGE AND SCIENTIFIC INQUIRY.		
1. Science is concerned with how and why natural phenomena occur and function. *		■
2. Controlled experiments differ from a random trial and error approach. *	■	
3. Scientific inquiry is used in investigations and experiments.		■
B. DEMONSTRATES KNOWLEDGE OF SCIENTIFIC CONTENT: ORGANISMS.		
EACH TYPE OF ORGANISM HAS ADAPTED TO SPECIFIC CONDITIONS FOR LIFE.		
1. There are characteristics which distinguish living from non-living organisms. *		■
2. Living things are interdependent. *	■	

DEMONSTRATES KNOWLEDGE OF SCIENTIFIC CONTENT: ORGANISMS. (CONT.)	5	6
3. Each organism is adapted by structure, function, and behavior to its environment. *	■	
4. The cell is the microscopic unit of structure basic to most living organisms. *		■
5. Organisms may be classified by similarities and differences in characteristics. *		■
6. Organisms have similar functions.	■	
7. Every species has a life cycle in which the same pattern of development is repeated from generation to generation. *		■
THERE IS CONTINUOUS EXCHANGE OF MATTER AND ENERGY BETWEEN ORGANISMS AND THEIR ENVIRONMENT.		
8. There are many cycles in an ecosystem.		■
9. The environment affects the survival of organisms. *		■
10. Living things capture matter and energy from the environment and return them to the environment. *		■
11. Organisms affect the environment.		■

**Essential objectives and skills are identified with an asterisk; however, they are not formally assessed.*

I. KNOWLEDGE

C. DEMONSTRATES KNOWLEDGE OF SCIENTIFIC CONTENT: MATTER AND ENERGY.

MATTER EXISTS IN VARIOUS FORMS WHICH HAVE SPECIFIC PROPERTIES.

1. The physical conditions of temperature and pressure determine in which of the states of matter a substance will be found.
2. Each kind of matter may be identified and classified by its characteristic physical and chemical properties. *
3. A physical change is a change in the size, shape, or state of matter. *
4. A chemical change is a change in the molecular structure of matter. *
5. Matter consists of particles.

ENERGY EXISTS IN VARIOUS FORMS WHICH HAVE SPECIFIC PROPERTIES

6. There are various forms of energy. *
7. Energy may be changed from one form to another. *
8. Energy must be applied to do work. *

D. DEMONSTRATES KNOWLEDGE OF SCIENTIFIC CONTENT: THE UNIVERSE.

ORDER AND CHANGE EXIST IN THE UNIVERSE.

1. There are many kinds of objects in space.

KNOWLEDGE

DEMONSTRATES KNOWLEDGE OF SCIENTIFIC CONTENT: THE UNIVERSE. (CONT.)

2. The relationships between the earth and the sun affect daily, seasonal, and annual changes in the environment.
3. As the earth rotates on its axis, it revolves around the sun.
4. The moon is the natural satellite of the earth.

THERE ARE PATTERNS IN THE UNIVERSE.

5. The motion of objects in space can be predicted. *
6. Conditions for life are affected by available sunlight.
7. There is continuous interaction between matter and energy throughout the universe. *

THERE ARE FORCES IN THE UNIVERSE.

8. Gravity and momentum affect the relationship of objects in space. *
9. Astronomers use a variety of instruments in observing changes in the universe.
10. The sun is the source of energy for life on earth. *

I. KNOWLEDGE

D. DEMONSTRATES KNOWLEDGE OF SCIENTIFIC CONTENT: THE UNIVERSE.(CONT.)

		5	6
11.	The amounts of the sun's energy absorbed by land, water, and air affect weather and climate. *		
12.	Earth's matter is in continuous change. *		
13.	The atmosphere affects the amount of solar energy reaching the earth.		
14.	Solar energy can be converted into other forms of energy. *		
15.	Light and matter interact in various ways.		

E. DEMONSTRATES THAT A SYSTEM IS A GROUP OF RELATED OBJECTS WHICH HAVE CERTAIN PROPERTIES AND FUNCTIONS.

A SYSTEM IS A GROUP OF RELATED OBJECTS OR EVENTS WHICH FORM A WHOLE.

		5	6
1.	Systems have specific properties, functions, and boundaries. *		
2.	A model may be designed to provide a possible explanation of how a system functions.		
3.	Objects within a system may interact.		
4.	There may be one or more sub-systems within a system.		

KNOWLEDGE

DEMONSTRATES THAT A SYSTEM IS A GROUP OF RELATED OBJECTS WHICH HAVE CERTAIN PROPERTIES & FUNCTIONS.(CONT.)

		5	6
	THERE ARE RELATIONSHIPS BETWEEN MATTER AND ENERGY.		
5.	Energy can be used to change matter from one state to another. *		
	THERE ARE RELATIONSHIPS BETWEEN MATTER AND ENERGY.		
6.	On earth, living things have an important part in the relationship between matter and energy. *		
7.	Matter and energy can be changed from one form to another, but the total sum of matter and energy remains the same. *		
8.	Interaction of matter and energy occurs in non-living things.		

II. THINKING PROCESSES

A. DEVELOPS ABILITY TO GENERATE DATA.

		5	6
1.	Explores, observes, and examines objects or events, using a combination of senses to collect and process data. *		
2.	Gathers and interprets data by using the appropriate instruments to aid the senses in making observations (appropriate to the learner's stage of development). * *		

II. THINKING PROCESSES

A. DEVELOPS ABILITY TO GENERATE DATA.(CONT.)	5	6
3. Determines the need to repeat observations as a means of improving reliability* and verifying data.		■
4. Identifies the names of objects and sequences of events. *	■	
5. Recalls information formerly obtained and integrates it with new information.		■
6. Identifies, names, and measures the conditions of changing events and the changes in characteristics of materials.		■
7. Uses direct comparisons and simple measurements to generate data. *		
B. DEVELOPS ABILITY TO ORGANIZE AND REPORT DATA.		
1. Develops and uses various classification systems. *		■
2. Organizes material in a serial or sequential form. *	■	
3. Develops ability to communicate data. *		■
C. DEVELOPS ABILITY TO APPLY AND EVALUATE DATA AND TO GENERATE HYPOTHESES.		
1. Identifies statements or data having direct relationship to the solution of a specific problem. *		■

THINKING PROCESSES

DEVELOPS ABILITY TO APPLY AND EVALUATE DATA AND TO GENERATE HYPOTHESES. (CONT.)	5	6
2. Suggests possible reasons as to why and how events have taken place. *		
3. Predicts and draws inferences from data. *	■	■
4. Evaluates consistency and accuracy of data obtained. *	■	
5. Recognizes the differences between facts and hypotheses. *	■	■
6. Designs simple investigations to support or refute a hypothesis. *	■	■
D. PARTICIPATES IN SCIENTIFIC INQUIRY AT THE APPROPRIATE LEVEL.		
1. By questioning, identifies and delineates a problem by forming questions likely to be answered through investigation. *		■
2. Proposes a possible answer to identified problems. *		
3. Plans an experiment or an appropriate science investigation. *	■	
4. Generates, records, and organizes data. *	■	■

II. THINKING PROCESSES

D. PARTICIPATES IN SCIENTIFIC INQUIRY AT THE APPROPRIATE LEVEL. (CONT.)

	5	6
5. Analyzes, evaluates, and interprets data, reaching a judgment about situations or events. *	■	
6. Summarizes experiences and relates them to others. *	■	

III. SKILLS

A. ASSEMBLES AND USES LABORATORY APPARATUS.

	5	6
1. Selects and manipulates science materials and equipment in a safe manner. *	■	■
2. Follows directions and safety procedures in classroom and individual laboratory investigations. *	■	■

B. DEMONSTRATES PROPER TECHNIQUES IN HANDLING AND CARING FOR LIVING ORGANISMS.

	5	6
1. Handles classroom animals and plants in a careful and safe manner, following prescribed procedures. *	■	■
2. Provides and maintains environments for animals and plants that are conducive to optimum life functions.		
3. Develops and maintains a record system for living organisms delineating their life processes and environmental relationships.		■

SKILLS

C. GATHERS DESCRIPTIVE AND QUANTITATIVE INFORMATION

	5	6
1. Makes and records observations of objects and events, identifying basic characteristics. *	■	
2. Asks relevant questions. *		■
3. Identifies and orders objects by basic characteristics. *	■	

GATHERS DESCRIPTIVE AND QUANTITATIVE INFORMATION.

	5	6
4. Utilizes quantitative methods to gather information. *		■
5. Describes expected outcome from data of past observations.		■
6. Seeks and evaluates explanatory ideas of others.	■	

D. GATHERS DATA AND IDEAS, USING READING SKILLS.

	5	6
1. Selects and uses science textbooks, reading references, and audio-visual materials. *		■
2. Utilizes appropriate reading skills in comprehending science content. *	■	■

E. RECORDS, ORGANIZES, AND PRESENTS DATA AND IDEAS, USING MATHEMATICAL SKILLS.

	5	6
1. Records data from observations in an appropriate graphic format. *		

III. SKILLS	5	6
E. RECORDS, ORGANIZES, AND PRESENTS DATA AND IDEAS, USING MATHEMATICAL SKILLS.(CONT.)		
2. Uses mathematical tools in manipulating data and solving problems. *	■	■
3. Constructs scaled models of objects in three-dimensional shapes.		■
4. Uses S.I metric and English systems effectively. *	■	
F. RECORDS, ORGANIZES, AND PRESENTS DATA AND IDEAS, USING ORAL AND WRITTEN LANGUAGE SKILLS.		
1. Explains orally or in writing data, methods, and procedures. *		■
2. Develops a science vocabulary. *	■	■
IV. ATTITUDES		
A. SHOWS CURIOSITY		
1. Examines unfamiliar objects and events carefully. *	■	■
2. Relates classification to everyday-life situations.	■	
B. SHOWS AN AWARENESS OF AND RESPONSE TO BEAUTY AND ORDERLINESS IN THE ENVIRONMENT.		
1. Expresses consciousness of and/or pleasure in spatial relationships and environments. *	■	■

ATTITUDES	5	6
SHOWS AN AWARENESS OF AND RESPONSE TO BEAUTY AND ORDERLINESS IN THE ENVIRONMENT.(CONT.)		
2. Seeks opportunities to share ideas with other persons about the relationships within the universe, including the immediate environment. *	■	
3. Shows evidence of enthusiasm when observing scientific phenomena.	■	■
4. Shows a willingness to examine and organize objects and events in the environment. *		■
C. APPRECIATES AND RESPECTS THE NATURAL ENVIRONMENT AND ALL LIVING ORGANISMS (INCLUDING SELF)		
1. Understands concern for the safety and well-being of self and others. *		
2. Accepts responsibility for the humane treatment of living organisms in natural and artificial environments.		
3. Shows appreciation of both the interdependence of living organisms in the natural environment and the implications of that interdependence for their continued survival. *	■	■
D. TAKES AN ACTIVE ROLE IN SOLVING SOCIAL PROBLEMS RELATED TO SCIENCE AND TECHNOLOGY.		
1. Practices conservation in use of food, energy, and materials. *	■	■
2. Shows concern and responsibility for conserving human and natural resources. *		■

		5	6
E.	WEIGHS ALTERNATIVE SCIENTIFIC, ECONOMIC, PSYCHOLOGICAL, AND SOCIAL FACTORS.		
	1. Considers possible resolutions to some problems.		■
	2. Shows a willingness to change the experimental conditions when seeking explanations about events. *	■	
F.	ORGANIZES AND REPORTS THE RESULTS OF SCIENTIFIC INVESTIGATIONS IN AN HONEST AND OBJECTIVE MANNER.		
	1. Reports data and ideas willingly. *	■	
	2. Seeks and considers explanations of others. *	■	
G.	SHOWS A WILLINGNESS TO SUBJECT DATA AND IDEAS TO CRITICAL EVALUATION OF PEERS.		
	1. Shows willingness to share tentative ideas and explanations with others and seeks and considers their critical evaluations. *		■
	2. Reacts to discrepancies in a positive and objective manner. *		■
H.	HAS A CRITICAL, QUESTIONING ATTITUDE TOWARD INFERENCES, HYPOTHESES, AND THEORIES.		
	1. Points out contradictions between data and conclusions. *		
	2. Shows willingness to change ideas in the light of new evidence.		

		5	6
I.	APPLIES THINKING PROCESSES WHEN INVESTIGATING RELSTIONSHIPS AND SOLUTIONS TO PROBLEMS.		
	1. Uses senses to analyze and report phenomena. *		
	2. Looks for problems and notes discrepancies. *		
J.	VALUES SCIENCE AS AN ENDEAVOR OF HUMAN BEINGS FROM ALL RECIAL, ETHNIC, AND CULTURAL BACKGROUNDS.		
	1. Values the scientific contributions of human beings from varied cultural backgrounds. *	■	■
	2. Recognizes that cultures throughout the world have contributed to the growth of scientific knowledge. *	■	■
K.	CONSIDERS SCIENCE-RELATED CAREERS AND MAKES REALISTIC DECISIONS ABOUT PREPARING FOR SUCH CAREERS.		
	1. Shows respect for the many science-related careers of people in our society. *	■	■

ENVIRONMENTAL EDUCATION GRADE CHARTS	5	6
SYMBOLS ---- = AWARENESS/EXPOSURE □ = INTRODUCTION/DEVELOPMENT ■ = MASTERY/EMPHASIS ——— = MAINTENANCE/REINFORCEMENT		
ECOLOGICAL RELATIONSHIPS To develop an understanding of basic ecological relationships and human dependence on a healthy global ecosystem.		
Understands that the sun is the source of energy for life on earth.		■
Is able to describe a food chain and apply the concept to components in an ecosystem.		■
Recognizes biological balances in an ecosystem respecting populations, energy flow, and producer-consumer relationships.	■	■
Understands the "Spaceship Earth" concept of limited biological capacity and the interdependence of all life.		■
Describes human dependency on natural biological systems.		■

ECOLOGICAL RELATIONSHIPS (CONT.)	5	6
Describes recent human disturbances in natural ecosystems, such as pollution and new land use, and the consequences of such actions.		■
Understands the concept of exponential growth as applied to populations, energy, and resource use.		□
Understands the concept of communities of living things, bound by relationships of an ecosystem, in which a variety of characteristic roles are filled.	□	
Understands trophic energy levels in an ecosystem.		□
Describes energy systems as essentially operating in one direction: toward less useful energy (2nd Law of Thermodynamics); understands the implications for contemporary society.		□
RESOURCE DEPENDENCE, USE, AND MANAGEMENT		
To develop an understanding of human dependency on resources and the importance of resource management.		
Recognizes what humans need from the environment.		

RESOURCE DEPENDENCE, USE, AND MANAGEMENT (CONT.)	5	6
Is able to differentiate between renewable and non-renewable resources.	■	
Recognizes the current dependency of our nation and most nations on petroleum as an energy resource.	■	
Cites examples of resources transported considerable distances for processing, manufacturing, and marketing, all of which require energy.	■	
Understands the finite nature of many current energy resources and the implications for society.	■	
Demonstrates knowledge of methods of forecasting future resource use from current trends.		○
Describes the functions of national, state, and local agencies which are responsible for resource management.	○	
AESTHETICS		
To develop an appreciation of natural beauty, the values of wilderness, and a respect for all forms of life.		
Observes, records, and describes feelings about natural beauty in the school, community, and home.		

AESTHETICS (CONT.)	5	6
Creates a personal environment which includes examples of natural beauty.	■	
Supports and works with others to preserve outstanding examples of natural beauty and of cultural and historical resources.		○
Considers aesthetics in career choices and recreational pursuits.		○
VALUES -- SOCIAL MECHANISMS		
To understand how values, ethics, and morality form the basis upon which environmental decisions are made.		
Describes the resources involved in fulfilling personal value choices.		
Participates in setting up and following simple school rules regarding pollution, resource use (and waste), and energy conservation.	■	
Assesses the environmental effect of value choices in other cultures.	○	
Identifies the factors which shape our personal and social values and understands the consequences of these held values.		○

VALUES -- SOCIAL MECHANISM (CONT.)	5	6
Explains the roles of state and national agencies in environmental matters and describes the concepts of lobbying and trade-offs.	----	-□—
Describes the resources used, the energy involved, and the pollution generated as a result of the manufacture of commonly distributed products.	—□—	
Identifies the factors which shape the personal and social values of subcultures within our nation and the factors which shape values in other cultures of the world.	----	-□—
Analyzes the economic implications of resource shortages, pollution costs, and land use within the context of such current economic categories as balance of payments, gross national product, and growth.	----	-□—
Cites examples of economic and governmental organizations affecting resource use through application of policies and programs "blind" to environmental costs.	----	-□—

PERSONAL LIFE-STYLES	5	6
To develop a personal life-style which supports the environmental rights of others and contributes to the maintenance of a healthy and productive physical environment.		
Practices conservation in the use of all resources.	——	—■
Describes the relationship between individual life-style choices, environmental health, and resource consumption.	—□—	——
Participates in resource conservation activities, such as recycling programs, cleaning up litter, and conserving energy.	——	——
Compares living conditions in other countries and at other times in history with those of contemporary America.	----	-□—
Demonstrates knowledge of criteria for selecting personal activities, such as recreation, transportation, and consumer decisions, which are based on environmental impact and energy use.	----	-□—
Observes and describes examples of individual and social behavior in a variety of national and worldwide situations and their effects on the participating peoples and institutions.	----	-□—

ENVIRONMENTAL PROBLEM-SOLVING	5	6
To develop the ability to create viable solutions to environmental problems and to work independently or cooperatively to implement them.		
Assesses the home-school environment and identifies simple problems, such as creation of litter, and waste of materials, water, and energy.		
Uses simple tools and works with other persons to keep home and school environments healthy and to conserve resources.		
Evaluates personal or social behavior in the community which adversely affect environmental health.		
Identifies the various social organizations and institutions which affect environmental decision-making and participation in conservation activities.		
Demonstrates skill in working independently or cooperatively to conduct simple surveys, to use monitoring equipment, and to seek information on environmental problems from appropriate agencies and individuals.		

ENVIRONMENTAL PROBLEM-SOLVING (CONT.)	5	6
Collects and evaluates data on local, state, national, or international environmental problems and predicts the effects of these conditions on the ecosystem.		
Demonstrates skills in organizing peers or participating in solving a variety of environmental problems, using skill and knowledge from a variety of areas.		

SECONDARY SCIENCE CONTINUUM

CODED OBJECTIVES

APPENDIX C

INTRODUCTION TO THE SCIENCE CONTINUUM, GRADES 7-12

PURPOSES

Science is the discipline which involves the acquiring and organizing of knowledge to explain natural phenomena and to increase their usefulness to humankind. Through the science instructional program in secondary schools, students develop an understanding that science is a body of knowledge comprised of interconnected sets of principles, laws, and theories that explain the known universe and our relationship to it. Students use learning processes to systematically investigate phenomena and acquire and refine information. Outcomes include understanding how human beings use scientific information and discoveries to comprehend and practice the pursuit of objective knowledge as a source of truth.

COMPONENTS

The Science Continuum encompasses the four competency strands of attitudes, thinking processes, skills, and knowledge. Within each strand, the continuum includes objectives and the kinds of performance necessary for the student to achieve each objective. However, the continuum does not limit the scope of the science curriculum. Teachers should encourage students to progress to the extent of their interests and abilities. In the continuum, certain symbols are used. Items with a solid dot identify the expectancy level for all students. Those items without dots identify levels above those expected for all students. An open circle in the K-6 column indicates that certain items are first introduced to the student in elementary school.

Attitudes Strand. This strand emphasizes the development of values, aspirations, and attitudes which promote the personal involvement of the individual with the environment and society. The attitudes listed relate to what is hoped students will accomplish, individually, through self-motivation, as a result of science instruction. Positive attitudes toward science and learning are prerequisites to effective learning in other strands.

Objectives of the attitudes strand include the ability of the learner to: internalize scientific attitudes; establish the personal and social relevance of what has been learned about science, scientists, and society; and enjoy and appreciate science.

Thinking Processes Strand. The goal is to help the student develop and apply rational and creative thinking processes. As defined here, these processes refer to the cognitive techniques involved in scientific inquiry as well as those basic to all rational thinking. Such processes as observing, measuring, comparing, and classifying lead to more sophisticated processes, such as inferring, generalizing, and theorizing.

Skills Strand. The goal is to help the student develop and use fundamental skills in the manipulation of materials and equipment, in caring for and handling living organisms, and in gathering, organizing, and communicating information relating to science. Various skills are utilized when the student employs thinking processes to develop a conceptual understanding of the natural environment and collects information through observation, manipulation of materials and apparatus, reading, listening, use of measuring instruments, and handling of living organisms. He or she employs linguistic, mathematical, graphical, and tabular skills in recording and organizing information.

A major goal of science education is the provision of opportunities for learners to develop and use these manipulative and communicative skills. Many areas of the curriculum relate closely to the skills that are critical to science education. Reading, writing, speaking, and listening skills are all basic to the communication needs of science students. Many of the skills described in the section are essential in a broad spectrum of occupations. For example, people in almost every occupation must be able to obtain, record, process, interpret, and report information and to communicate ideas in a clear, convincing manner. The skills goal is not only critical to science education, but it is also important in the development of competencies necessary for effective citizenship.

Knowledge Strand. The goal is to assist the student in developing knowledge of processes, facts, principles, generalizations, and applications -- the products of science -- and to encourage their use in the interpretation of the natural environment. Acquisition of organized knowledge is a long-range goal of science and science education. Through an understanding of contributing facts, unifying principles, and relevant processes, organized knowledge gradually takes on meaning for the learner. He or she will acquire some knowledge as a by-product of instruction intended to develop attitudes, skills, and thinking processes and will acquire other knowledge as a deliberate result of instruction. At all levels, the knowledge goal must be in balance with and consistent with the other goals of science education.

Four types of knowledge can be highlighted as components of this goal: (1) knowledge that enables the learner to communicate the thinking processes and skills of science; (2) knowledge that constitutes broad generalizations which interrelate the many facts, concepts, and principles of all the sciences; (3) knowledge of how science and technology affect society; and (4) knowledge that constitutes the content, basic concepts, and structure of the major disciplines in science.

IMPLEMENTATION

Through the in-service process, the teacher should become fully cognizant of the Science Continuum, its rationale, and its possible use. The goals and objectives of the continuum are basic to all science courses and are consistent with the provisions of AB 65 and the forthcoming State Science Framework. District-developed pretests and posttests are planned to assist teachers in evaluating each student's level of achievement in relation to the Science Continuum. The results of pretests should be used in planning instruction to meet more effectively group and individual needs. In addition, the teacher should formulate a variety of ways to assist the student needing additional instruction.

Approaches to instruction may include:

Development of learning centers
Assignment to independent study projects
Improvement of classroom management

Use of additional instructional resources
Introduction of changes in organization within the science department;
e.g., use of minicourses, team teaching
Expansion of tutoring program
Improvement of counseling

Pretests and other tests prepared by the teacher should:

Be used to evaluate continuum goals and learner performance objectives.
Consist only of items based on performance objectives expected of all students.
Assess understanding of science concepts rather than reading ability.
Avoid items which are of a controversial nature with respect to individual religious or political beliefs.
Relate to life situations common to individuals in all cultural groups.
Involve problem statements with supporting data, as expressed in graphs, tables, pictorials, and other illustrations.
Whereever possible, relate items from skills, thinking processes, and attitudes objectives to knowledge objectives.

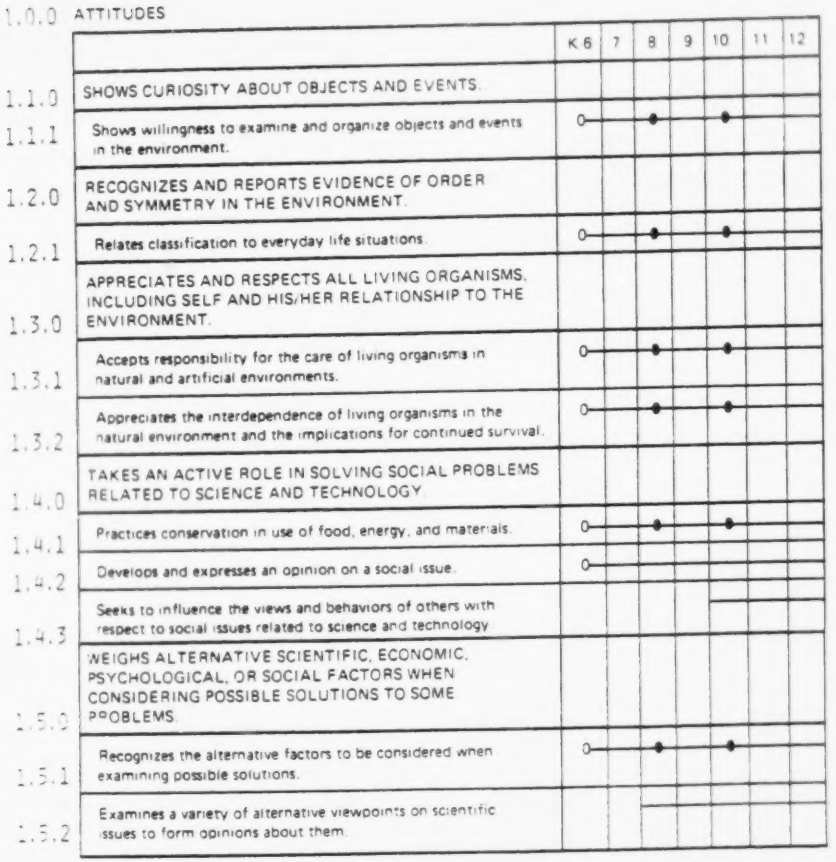
Test items related to attitudes should give the learner an opportunity to utilize knowledge applicable to the appropriate scientific attitude. This may or may not reflect the learner's personal attitude.

Test items related to thinking processes should be based on hypothetical problem-solving experiments and include questions that assess the student's understanding of scientific methods.

Test items related to skills should include questions about science apparatus, rules of safety, materials, and equipment common to both biological and physical sciences. Illustrations should be included.

SCIENCE CONTINUUM
GRADES 7-12

SYMBOLS
---- = Awareness/Exposure
0 = Introduction/Development
● = Assessment/Evaluation
——— = Maintenance/Reinforcement


1.0.0 ATTITUDES
K 6 7 8 9 10 11 12
1.1.0 SHOWS CURIOSITY ABOUT OBJECTS AND EVENTS.
1.1.1 Shows willingness to examine and organize objects and events in the environment.
1.2.0 RECOGNIZES AND REPORTS EVIDENCE OF ORDER AND SYMMETRY IN THE ENVIRONMENT.
1.2.1 Relates classification to everyday life situations.
1.3.0 APPRECIATES AND RESPECTS ALL LIVING ORGANISMS, INCLUDING SELF AND HIS/HER RELATIONSHIP TO THE ENVIRONMENT.
1.3.1 Accepts responsibility for the care of living organisms in natural and artificial environments.
1.3.2 Appreciates the interdependence of living organisms in the natural environment and the implications for continued survival.
1.4.0 TAKES AN ACTIVE ROLE IN SOLVING SOCIAL PROBLEMS RELATED TO SCIENCE AND TECHNOLOGY
1.4.1 Practices conservation in use of food, energy, and materials.
1.4.2 Develops and expresses an opinion on a social issue.
1.4.3 Seeks to influence the views and behaviors of others with respect to social issues related to science and technology
1.5.0 WEIGHS ALTERNATIVE SCIENTIFIC, ECONOMIC, PSYCHOLOGICAL, OR SOCIAL FACTORS WHEN CONSIDERING POSSIBLE SOLUTIONS TO SOME PROBLEMS.
1.5.1 Recognizes the alternative factors to be considered when examining possible solutions.
1.5.2 Examines a variety of alternative viewpoints on scientific issues to form opinions about them.

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ATTITUDES (CONT.)

		K-6	7	8	9	10	11	12
1.6.0	ORGANIZES AND REPORTS THE RESULTS OF SCIENTIFIC INVESTIGATIONS IN AN HONEST AND OBJECTIVE MANNER.							
1.6.1	Understands the need to log only those data he/she has actually gathered.	o		•		•		
1.6.2	Forms opinions only after seeking a variety of data and ideas.			•		•		
1.6.3	Assumes responsibility for reporting results in an honest and objective manner.	o		•		•		
1.7.0	HAS A CRITICAL, QUESTIONING ATTITUDE TOWARD INFERENCES, HYPOTHESES, AND THEORIES.							
1.7.1	Shows an interest in responding to contradictions between data and theory.							
1.8.0	APPLIES RATIONAL AND CREATIVE THINKING PROCESSES WHEN TRYING TO FIND RELATIONSHIPS AMONG SEEMINGLY UNRELATED PHENOMENA AND WHEN SEEKING SOLUTIONS TO PROBLEMS.							
1.8.1	Attempts spontaneously to describe an object or event that has attracted his/her attention.	o		•		•		
1.8.2	Applies science problem-solving techniques in everyday life situations.	o		•		•		
1.9.0	RECOGNIZES THE VALUES OF SCIENCE AS A HUMAN ENDEAVOR REPRESENTING ALL RACIAL, ETHNIC, AND CULTURAL BACKGROUNDS.							
1.9.1	Chooses to gather information and report on the contributions of all cultures to the scientific world.	o		•		•		
1.9.2	Acknowledges that race, sex, or nationality should not constitute a barrier to scientific study.	o		•		•		
1.9.3	Values the scientific contributions of human beings from varying cultural backgrounds.	o		•		•		

ATTITUDES (CONT.)

		K-6	7	8	9	10	11	12
1.10.0	CONSIDERS SCIENCE RELATED CAREERS AND MAKES REALISTIC DECISIONS ABOUT PREPARING FOR SUCH CAREERS, TAKING INTO ACCOUNT ABILITIES, INTERESTS, AND PREPARATION REQUIRED.							
1.10.1	Values the abilities, interests, and preparation required for a science-related career.			•		•		
1.10.2	Assumes responsibility for making a realistic decision about the pursuit of a science-related career.							

2.0.0 THINKING PROCESSES

		K-6	7	8	9	10	11	12
2.1.0	DEVELOPS ABILITY TO GENERATE DATA BY OBSERVING, RECALLING, RECOGNIZING, IDENTIFYING, AND MEASURING.							
2.1.1	Examines objects carefully, using a combination of senses to collect and process data; derives meaning from the observation; recognizes the need to use simple instruments to aid the senses in collecting data.	o		•		•		
2.1.2	Determines the need to repeat observations as a means of improving reliability.	o		•		•		
2.1.3	Uses measurement procedures to improve accuracy of observations.	o		•		•		
2.1.4	Identifies changes in properties and rates of change.	o						
2.2.0	DEVELOPS ABILITY TO ORGANIZE DATA BY COMPARING, CLASSIFYING, RELATING, AND ORDERING.							
2.2.1	Perceives similarities and differences in a set of objects; separates a set into groups according to a single characteristic.	o		•		•		
2.2.2	Develops arbitrary classification systems wherein objects can be put into mutually exclusive categories; uses quantitative measurements as criteria for grouping.							

THINKING PROCESSES (CONT.)

		K-6	7	8	9	10	11	12
2.3.0	DEVELOPS ABILITY TO APPLY AND EVALUATE DATA AND GENERATE THEORIES BY HYPOTHESIZING, PREDICTING, INFERRING, GENERALIZING, THEORIZING, EXPLAINING, JUSTIFYING, JUDGING, AND INTERPRETING.							
2.3.1	Examines environmental issues, pointing out contradictions and discrepancies in the positions of various groups.							
2.3.2	Gathers own data to form own point of view, satisfying any former contradictions.	○						
2.3.3	Recognizes contradictions and unusual events.							
2.3.4	Designs experiments to produce specific data to support or refute a hypothesis.							
2.4.0	PARTICIPATES IN SCIENTIFIC INQUIRY AT THE APPROPRIATE LEVEL.							
2.4.1	Defines a problem related to an unusual event.							
2.4.2	Identifies data needed to test a hypothesis; designs an experiment to generate the data; records and organizes data; and evaluates the hypothesis in light of new data.							

3.0.0 SKILLS

		K-6	7	8	9	10	11	12
3.1.0	ASSEMBLES AND USES LABORATORY APPARATUS, TOOLS, AND MATERIALS IN A SKILLFUL MANNER, GIVING DUE ATTENTION TO SAFETY MEASURES.							
3.1.1	Manipulates simple materials, apparatus, and equipment in a safe manner.	○		●		●		
3.1.2	Demonstrates growth in the ability to manipulate more complex science materials and equipment.			○		●		
3.1.3	Acquires and assembles appropriate science apparatus, materials, and equipment in order to obtain designated data.							

SKILLS (CONT.)

		K-6	7	8	9	10	11	12
3.2.0	DEMONSTRATES PROPER TECHNIQUES FOR HANDLING AND CARING FOR LIVING ORGANISMS.							
3.2.1	Handles plants and animals carefully, following suggested procedures.	○		●		●		
3.2.2	Provides an environment for plant and animal life that is conducive to the support of normal life functions.	○		●		●		
3.3.0	GATHERS THE INFORMATION NEEDED FOR DEVELOPING OR TESTING INFERENCES AND HYPOTHESES BY MAKING PURPOSEFUL, OBJECTIVE OBSERVATIONS OF THINGS AND EVENTS.							
3.3.1	Makes purposeful, objective observations.	○		●		●		
3.3.2	Determines the timing of a series of events.							
3.4.0	GATHERS NEEDED INFORMATION, WHICH HAS BEEN GENERATED BY OTHERS, FROM A VARIETY OF SOURCES APPROPRIATE TO HIS/HER ABILITY LEVEL.							
3.4.1	Listens to the ideas of others.	○		●		●		
3.4.2	Gathers information from science textbooks, reference materials, science films, and television.	○		●		●		
3.4.3	Finds sources of information needed to solve a problem related to a specific topic.	○		●		●		
3.5.0	RECORDS OBSERVATIONS ACCURATELY AND ORGANIZES DATA AND IDEAS IN WAYS THAT IMPROVE THEIR USEFULNESS.							
3.5.1	Orally describes a series of events that have taken place.	○		●		●		
3.5.2	Tabulates information and uses tables.							
3.5.3	Interprets graphs and displays data graphically.	○						
3.6.0	COMMUNICATES WITH OTHERS IN A MANNER THAT IS CONSISTENT WITH KNOWLEDGE.							
3.6.1	In group settings, orally describes observations and answers questions.	○		●		●		
3.6.2	Explains, either orally or in writing, the methods and procedures involved in carrying out an investigation.	○						

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SKILLS (CONT.)

		K-6	7	8	9	10	11	12
3.7.0	USES THE METRIC SYSTEM EFFECTIVELY.							
3.7.1	Counts, uses numbers, and balances objects on an equal-arm balance scale.	○		●		●		
3.7.2	Measures linear distances, using a metric ruler.	○		●		●		
3.7.3	Uses a balance to determine the mass of objects.	○		●		●		
3.7.4	Measures volume of liquids in a graduated cyclinder marked in metric units.							
3.8.0	APPLIES APPROPRIATE MATHEMATICAL CONCEPTS AND SKILLS IN INTERPRETING DATA AND IN SOLVING PROBLEMS.							
3.8.1	Calculates rates from data.							
3.8.2	Finds the mean and median of a series of measurements.							
3.8.3	Utilizes exponential notation to express very large and very small numbers.							
3.8.4	Determines degree of precision of measurement and quantities derived from measurements.							
3.8.5	Uses calculators and/computers to advantage in manipulating data and solving problems.							

4.0.0 KNOWLEDGE

		K-6	7	8	9	10	11	12
4.1.0	DEMONSTRATES KNOWLEDGE OF THE PROCESSES OF SCIENTIFIC INQUIRY.							
4.1.1	Distinguishes between trial and error and controlled investigations.	○		●		●		
4.1.2	Matches names of various processes and products of scientific inquiry with examples.							
4.1.3	Evaluates procedures in the inquiry process that have been omitted or inadequately performed.							

KNOWLEDGE (CONT.)

		K-6	7	8	9	10	11	12
4.2.0	DEMONSTRATES UNDERSTANDING OF BASIC GENERALIZATIONS, RELATIONSHIPS, AND PRINCIPLES.							
4.2.1	Identifies simple cause-effect relationships.	○		●		●		
4.2.2	Uses a cause-effect relationship to make a prediction.	○						
4.2.3	Recognizes that atoms are composed of electrons, protons, neutrons, and other particles.	○				●		
4.2.4	Recognizes that electrons are negatively charged and protons are positively charged.							
4.2.5	Illustrates that the number of atomic particles varies with each element.							
4.2.6	Recognizes that matter is composed of particles which are in constant motion.							
4.2.7	Describes interaction and reorganization of units of matter and their association with changes of energy.							
4.2.8	Recognizes the uses of fuels.	○		●		●		
4.2.9	Identifies examples of kinetic and potential energy.							
4.2.10	Identifies pairs of objects having similar properties.	○		●		●		
4.2.11	Describes systems of classification used to sort a group of miscellaneous objects.	○		●		●		
4.2.12	Recognizes that classification systems are developed by humans for the use of humans and are one way of helping to understand the basic organization and pattern of nature.			●		●		
4.3.0	DEMONSTRATES KNOWLEDGE OF RELATIONSHIPS BETWEEN SCIENCE AND SOCIETY.							
4.3.1	Gives examples of ways in which the use of scientific knowledge has affected society.	○		●		●		
4.3.2	Describes aspects of a society that tend to encourage or inhibit the advancement of science.							
4.3.3	Identifies types of data valuable in planning environmental changes.							

KNOWLEDGE (CONT.)

		K-6	7	8	9	10	11	12
4.4.0	DEMONSTRATES KNOWLEDGE OF SCIENCE-RELATED CAREER OPPORTUNITIES AND THE PREPARATION NEEDED.							
4.4.1	Compares the work performed by persons in science occupations.	○	—	—	—	—	—	—
4.4.2	Identifies ways in which careers are science related.	○	—	—	—	—	—	—
4.5.0	DEMONSTRATES KNOWLEDGE OF CONTRIBUTIONS TO SCIENCE AND TECHNOLOGY MADE BY MEN AND WOMEN OF VARIOUS RACES AND NATIONALITIES.							
4.5.1	Matches significant discoveries to persons responsible.	○	—	—	—	—	—	—
4.6.0	DEMONSTRATES KNOWLEDGE OF THE RELATIONSHIPS OF SCIENCE TO OTHER AREAS OF HUMAN ENDEAVOR.							
4.6.1	Identifies how modern techniques of determining the age of specimens contribute to knowledge of earlier civilizations.			—	—	—	—	—
4.7.0	DEMONSTRATES KNOWLEDGE OF WAYS IN WHICH ATTITUDES, THINKING PROCESSES, AND SKILLS CAN BE RELATED FOR USE IN PERSONAL DECISION-MAKING.							
4.7.1	Given a list of foods, identifies items that would constitute a nutritious, balanced meal.	○	—	●	—	●	—	—
4.7.2	Given manufacturers' literature and consumer research data, selects an object on the basis of comparison of various factors.			—	—	●	—	—
4.7.3	Uses data from scientific investigations in presenting a position on a political issue.			—	—	—	—	—
4.8.0	DEMONSTRATES GENERAL KNOWLEDGE OF SCIENCE.							
4.8.1	Recognizes that a cell is the basic unit of structure and function of a living organism.	○	—	●	—	●	—	—
4.8.2	Recognizes that all living organisms have the same life processes.	○	—	●	—	●	—	—
4.8.3	Demonstrates a basic knowledge of the structures and functions of the human organism.	○	—	●	—	●	—	—
4.8.4	Understands and describes living organisms that grow and develop in different environments.	○	—	●	—	●	—	—
4.8.5	Recognizes that the sun is the source of energy for green plants and is basic to the growth and maintenance of living organisms.	○	—	●	—	●	—	—

KNOWLEDGE (CONT.)

		K-6	7	8	9	10	11	12
4.8.6	Recognizes the importance of energy levels as related to ecosystems.			—	—	—	—	—
4.8.7	Recognizes that living organisms utilize matter and return it to the environment.	○	—	—	—	—	—	—
4.8.8	Describes examples of humankind's dependence on and interference with natural ecosystems.	○	—	●	—	●	—	—
4.8.9	Recognizes that a living organism is a product of its heredity and environment.	○	—	●	—	●	—	—
4.8.10	Recognizes that all forms of life are composed of the same elements in different DNA blueprints.			—	—	—	—	—
4.8.11	Understands relationships of structure and function of living organisms to their environment.			—	—	●	—	—
4.8.12	Recognizes that living organisms have changed over the ages and that some species are now extinct.	○	—	●	—	●	—	—
4.8.13	Recognizes that the motion and path of celestial bodies are predictable.	○	—	●	—	●	—	—
4.8.14	Describes the regular movements of the earth and moon.	○	—	●	—	●	—	—
4.8.15	Demonstrates an appreciation and understanding of time/space relationships.	○	—	—	—	—	—	—
4.8.16	Demonstrates knowledge of basic differences between planets, stars, the solar system, the Milky Way Galaxy, and the known universe.	○	—	●	—	●	—	—
4.8.17	Cites some of the accomplishments in humankind's exploration of space.	○	—	●	—	●	—	—
4.8.18	Demonstrates knowledge of the effects of moon and sun on ocean tides.	○	—	—	—	—	—	—
4.8.19	Recognizes that matter exists as solids, liquids, and gases.	○	—	●	—	●	—	—
4.8.20	Demonstrates that in chemical or physical changes the total amount of matter remains unchanged.	○	—	●	—	●	—	—
4.8.21	Recognizes that in nuclear reactions a loss of matter is a gain in energy; the sum of matter and energy remains constant.			—	—	—	—	—

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KNOWLEDGE (CONT.)

		K-6	7	8	9	10	11	12
4.8.22	Recognizes that there are continuous changes on earth.	O	—	●	—	●	—	—
4.8.23	Recognizes that rocks contain one or more kinds of minerals.	O	—	—	—	—	—	—
4.8.24	Recognizes the three major types of rocks that make up the earth.	- -	- -	—	—	—	—	—
4.8.25	Recognizes the value of using renewable energy sources instead of non-renewable sources.	O	—	●	—	●	—	—
4.8.26	Identifies major factors that cause weather changes and patterns.	- -	- -	—	—	—	—	—
4.8.27	Identifies the effect of weather on the local environment.	O	—	●	—	●	—	—
4.8.28	Identifies the ocean as a major influence on weather.	O	—	●	—	●	—	—
4.8.29	Recognizes simple machines and their functions.	O	—	—	—	—	—	—
4.8.30	Understands the definitions and interrelationships of force, work, and energy.			—	—	—	—	—